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furnace, and classified according to the temperature at which they appear and their response to increase of temperature.

Many scandium lines, notably a large group in the red, show high intensity at the lowest temperature stage used, 1900°-2000° C, some maintaining their strength and others weakening at higher temperatures. The majority, however, develop distinctly at about 2250° and strengthen rapidly as the temperature rises. Numerous cases are found of strong furnace lines which are relatively weak in the arc.

The enhanced lines, which are prominent in the scandium arc as well as in the spark, are of special interest in connection with the solar spectrum, since these are for the most part the lines which identify scandium in the Sun. In the furnace, many of the stronger enhanced lines appear, some of them at the medium temperature of 2250° C used in these experiments. This places the scandium enhanced lines in an intermediate position, as regards the excitation required to produce them, between those of titanium and those of the type of H and K of calcium, the latter appearing at still lower furnace temperatures.

The low-temperature lines of scandium in general appear with considerable strength in sun-spot spectra, tho faint or absent in the spectrum of the disk. Fowler noted a number of lines of this kind, which he produced in the flame of the arc, and the furnace adds to these some strong low-temperature lines which are faint in the arc. A comparison with large-scale photographs of the sun-spot spectrum shows a wide magnetic separation for many of the low-temperature scandium lines which are strengthened in the spot.

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FURTHER OBSERVATIONS ON THE FURNACE ABSORPTION-SPECTRUM OF IRON

In a recent study (*Astrophysical Journal*, **51**, 13, 1920) of the characteristics of absorption spectra produced by a furnace tube containing a diaphragm of graphite, it was noted that in the iron spectrum no absorption lines appeared of greater wave-length than λ5507. The furnace was operated in a partial vacuum, the graphite plug showing a temperature of 2600° C. The iron lines farther to the red are less subject to self-reversal in laboratory sources, and it was predicted that a still higher temperature would bring out the absorption spectrum of this region also.

Experiments have now been carried out at higher temperatures, the plug in some cases being heated well above 3200° C (the highest temperature readable on the optical pyrometer employed) in a furnace operated in air at atmospheric pressure, this condition being more favorable than a vacuum for the production of reversals. The iron spectrum was photographed as far as λ6678, and a strong spectrum was obtained, the stronger furnace lines very generally appearing in absorption. The character of the spectrum can be very closely described as corresponding to the spectrum given in emission at about 2350° C with no plug in the tube.

In the previous study, it was observed that in the blue region the absorption spectrum, as regards lines present and relative intensities, corresponds with that given in emission about 400° lower. For wave-lengths greater than λ6000 the required temperature difference for the emission and absorption spectra appears to be at least twice this interval. In other words, it has been found that a given furnace temperature produces a definite set of lines, usually distributed thru an extended region of the spectrum, and that to obtain the same set of lines in absorption, increasingly higher temperatures of the background are required as we go toward greater wave-length. Experiments are under way to obtain further data regarding this relation, which doubtless is closely connected with the well-known tendency in emission spectra of reversed lines to become more frequent in the region of shorter wave-length.

The different susceptibility to absorption of lines in different temperature classes is distinct in the red, as in the region previously studied. The lines appearing more readily are those in the lower-temperature classes, while the lines in Classes III and IV are relatively difficult to obtain in absorption.

The carbon bands λλ5165 and 5635 show their full structure in absorption at these high temperatures. At 3150° C, however, they are in a transition stage, with λ5165 beginning to show in absorption, and λ5635 not visible. At temperatures of the plug below 3000° C, these bands do not appear in absorption, having about the same susceptibility as the Class III lines of iron.

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